

NORTHWEST CLIMATE
CHANGE AND THE
COASTAL ZONE

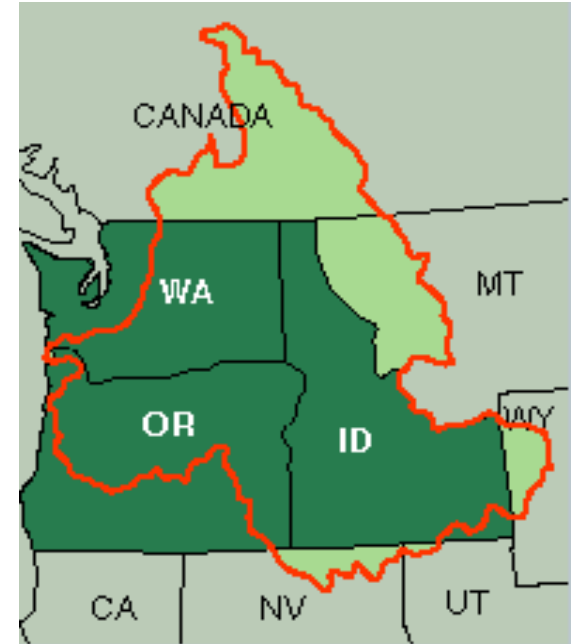
PHILIP MOTE
UNIVERSITY OF
WASHINGTON

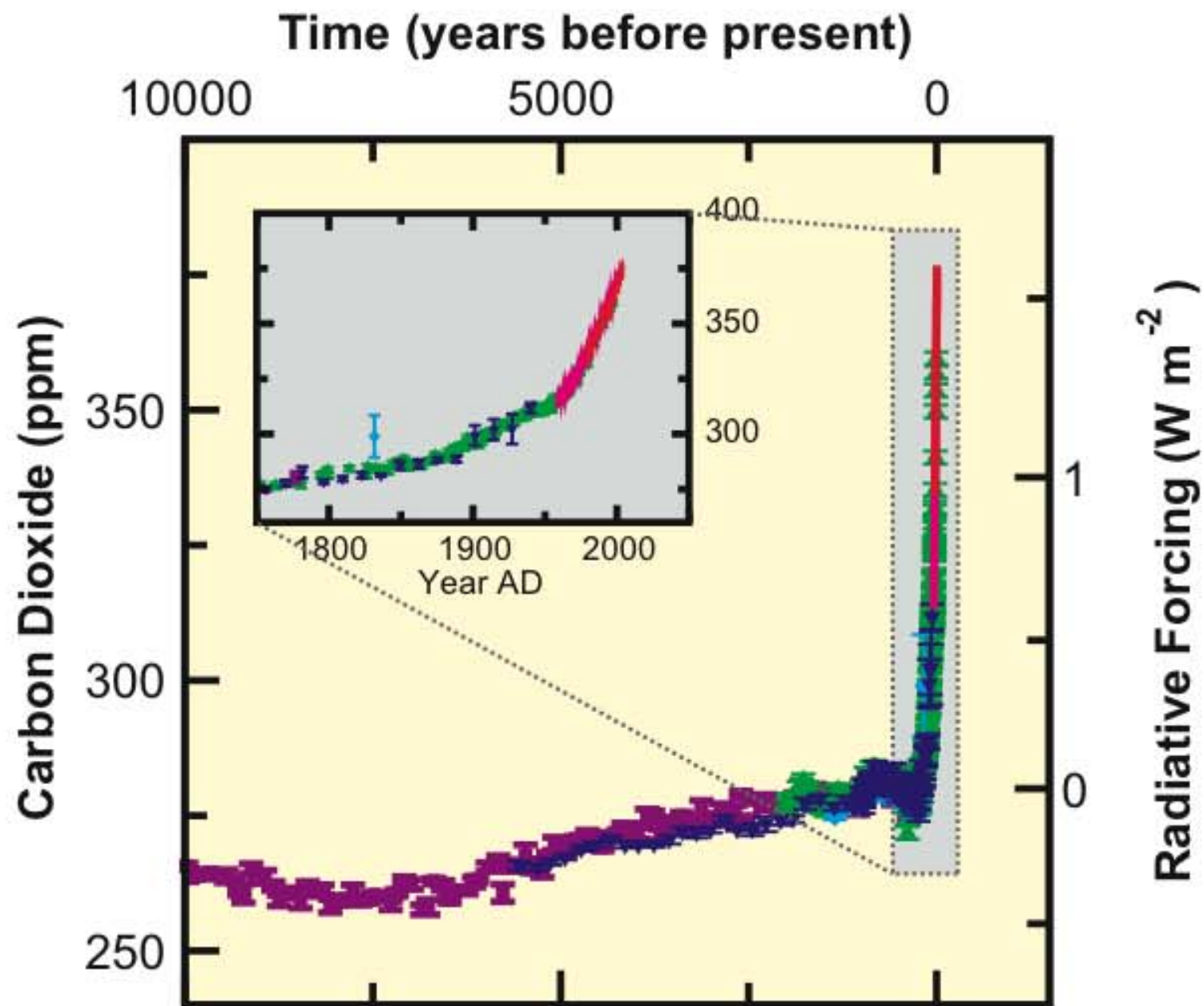
The Climate Impacts Group

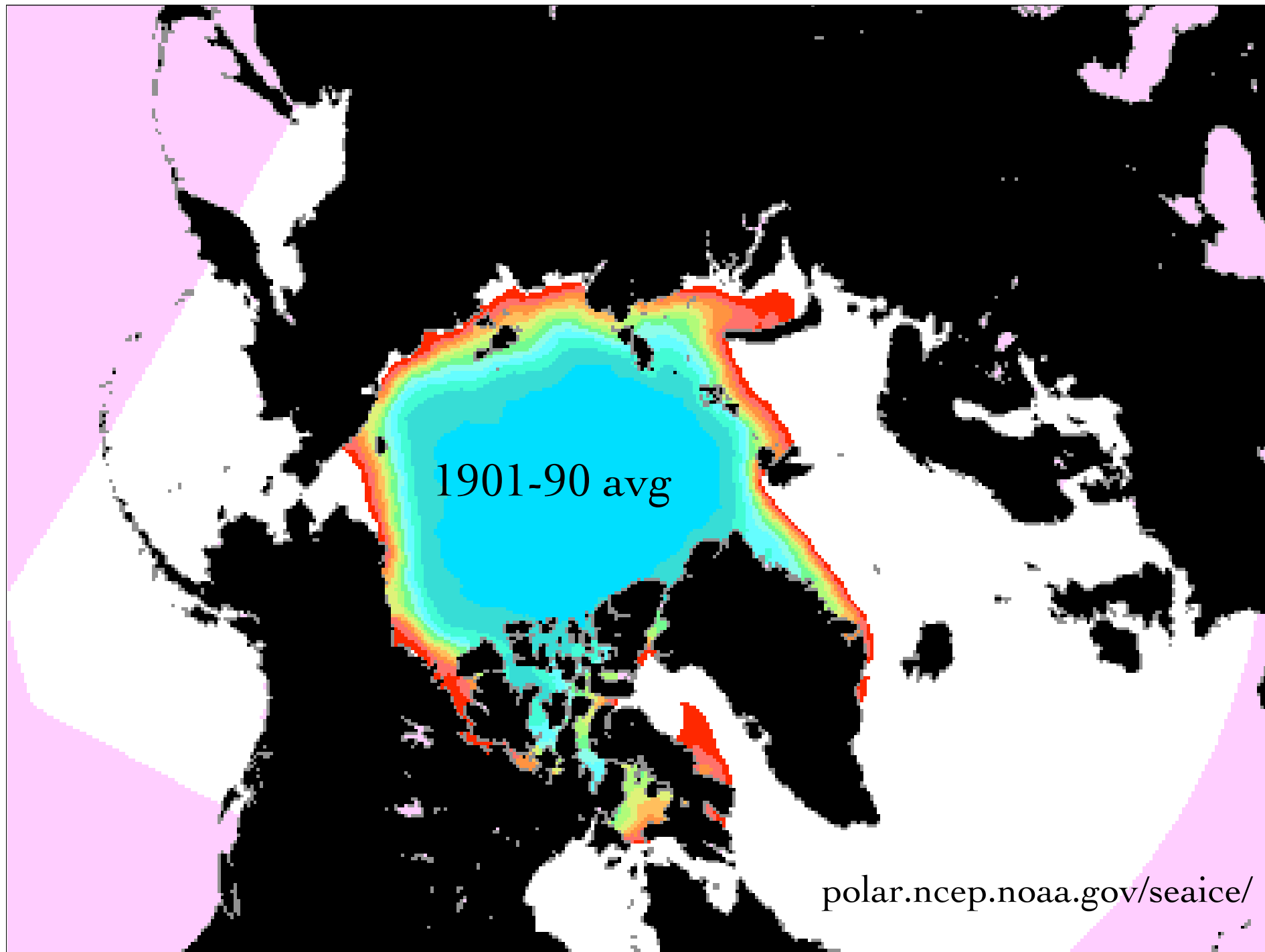
<http://cses.washington.edu/cig/>

Goal: help the Pacific Northwest become more resilient to climate variations and climate change

Supported by NOAA Climate Program Office as part of the Regional Integrated Science and Assessments (RISA) program





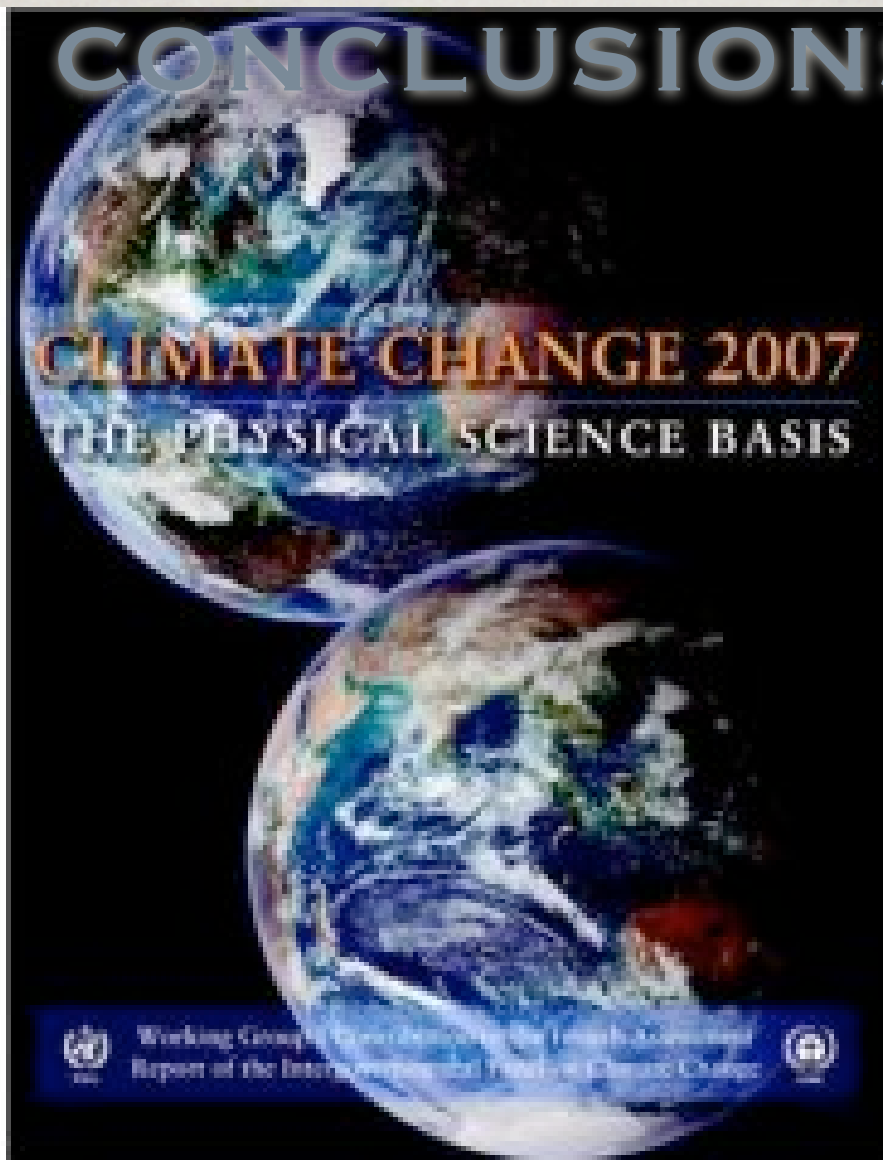


A map of the Arctic region showing sea ice extent for September 2007. The landmasses are depicted in black, while the surrounding oceans are white. The sea ice is represented by a color gradient: light blue for the central, thicker ice areas and transitioning to yellow and orange towards the edges, indicating thinner ice. The text "Sept 2007" is centered over the ice. The URL "polar.ncep.noaa.gov/seaice/" is located in the bottom right corner.

Sept 2007

polar.ncep.noaa.gov/seaice/

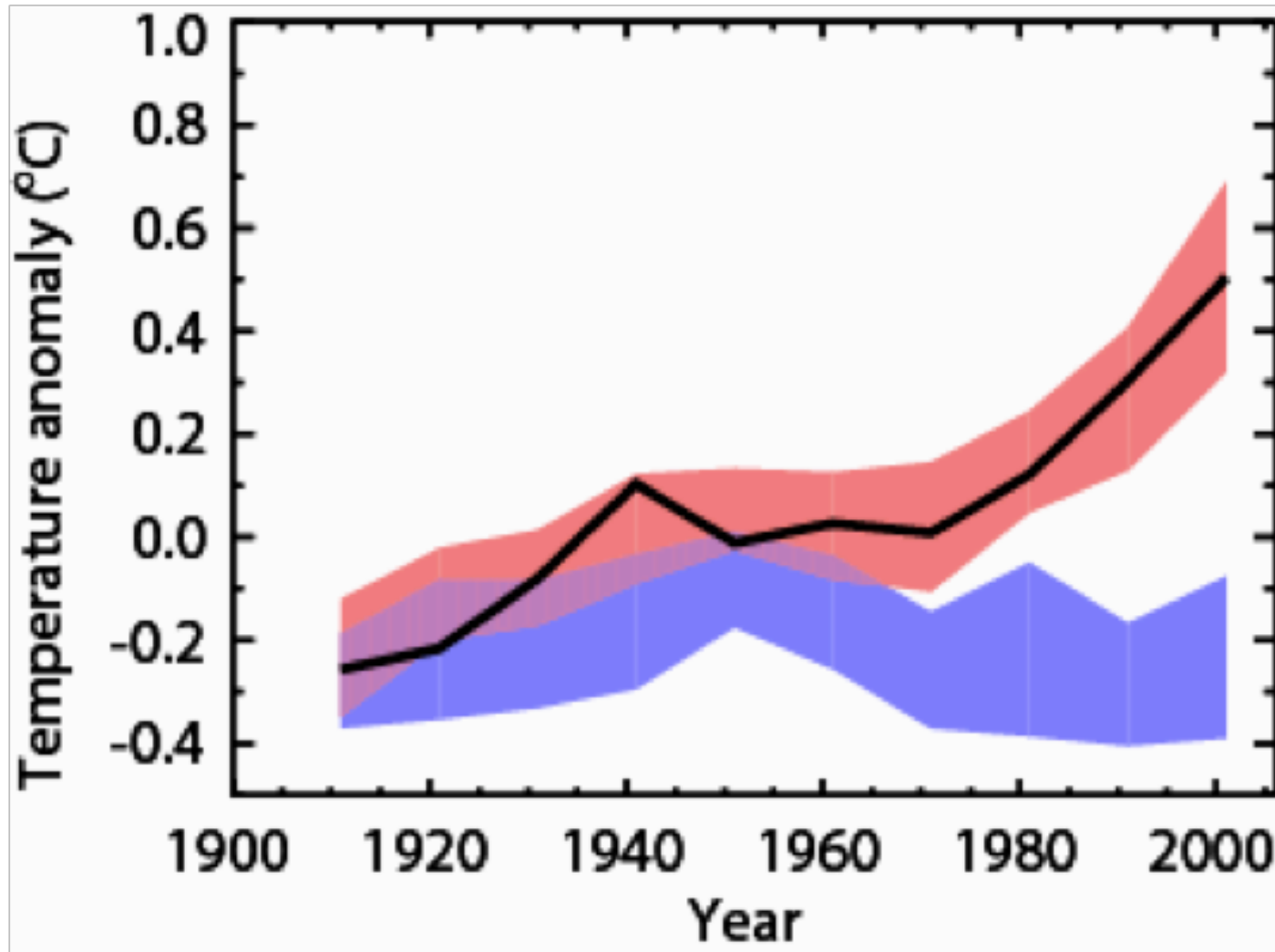
IPCC (2007) CONCLUSIONS



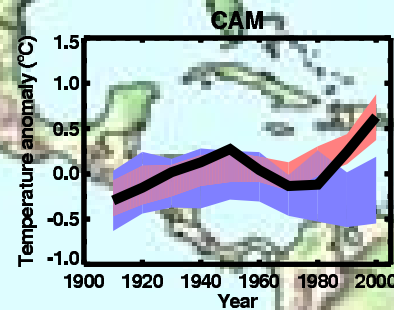
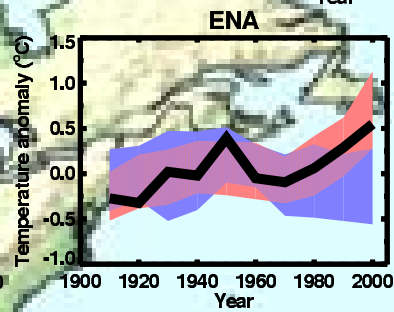
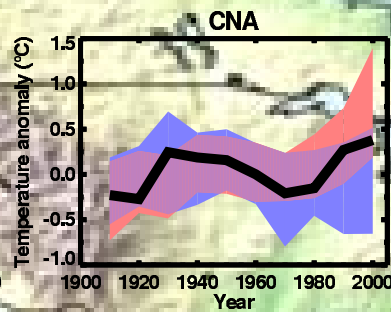
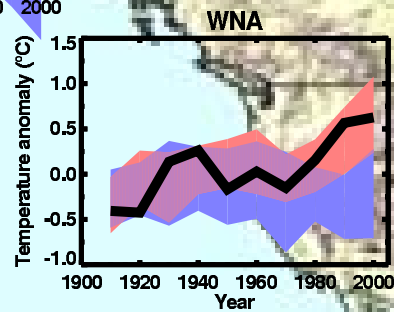
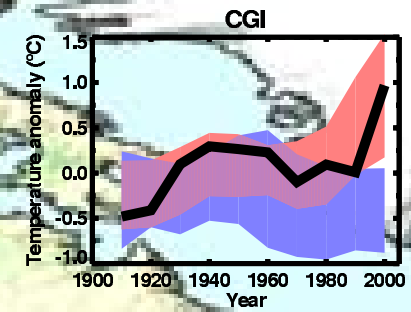
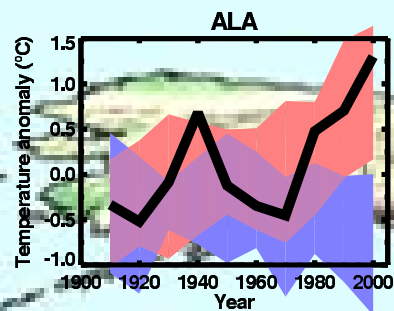
IPCC (2007) CONCLUSIONS

- warming of the climate is unequivocal
- Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations

Global mean temperature

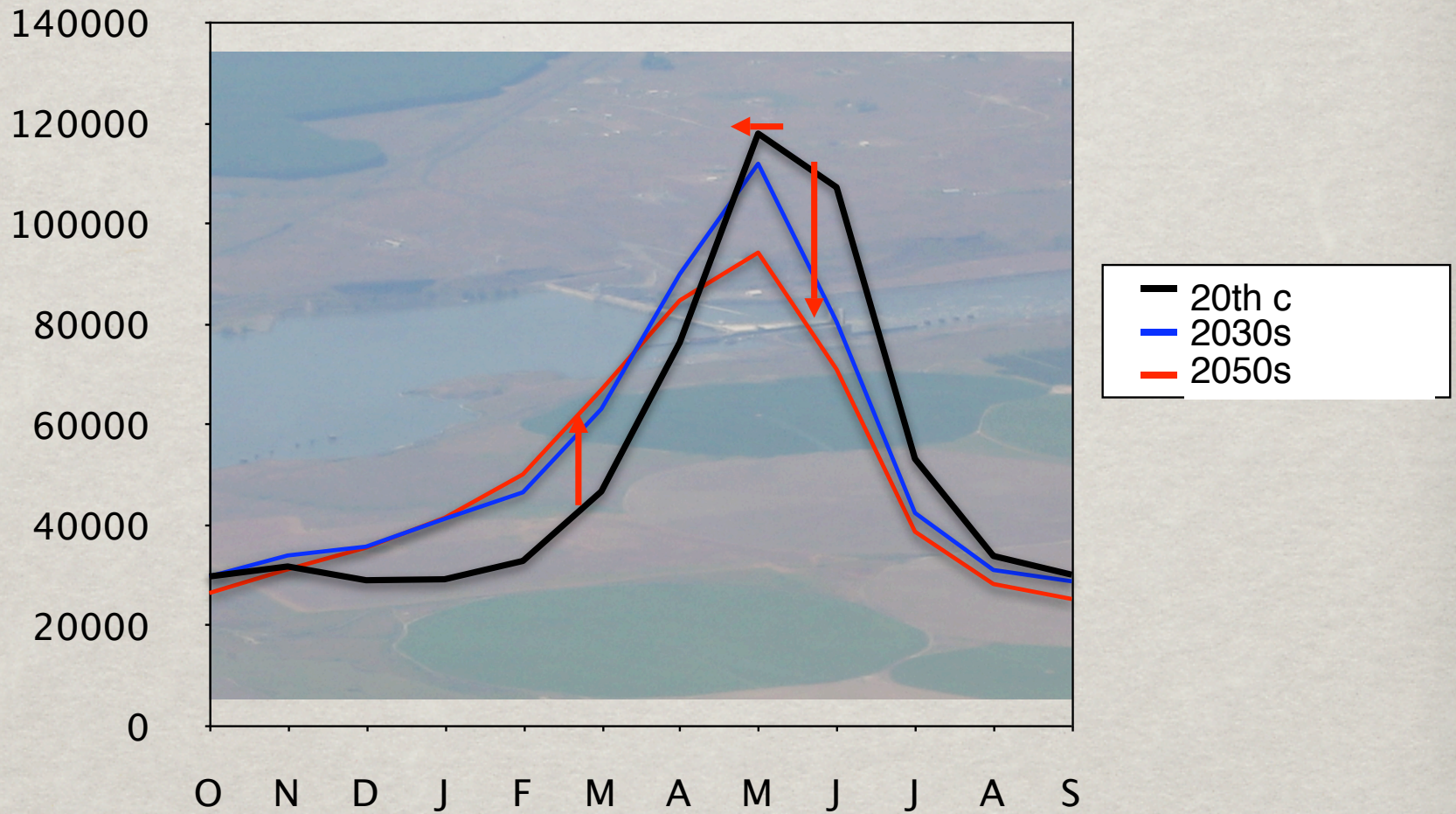


REGIONAL ATTRIBUTION

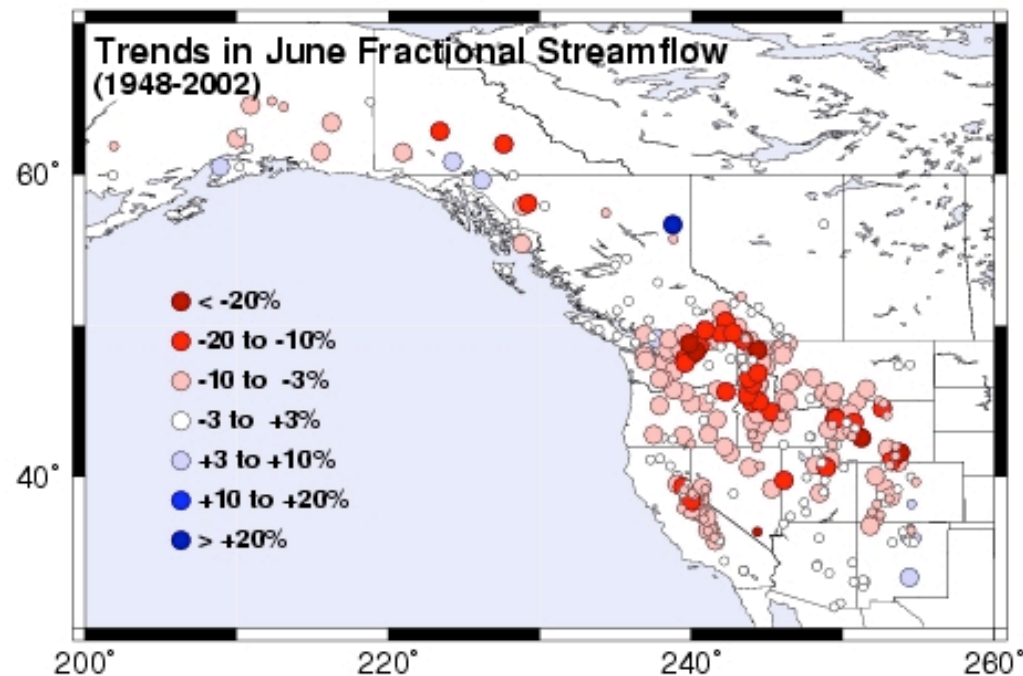
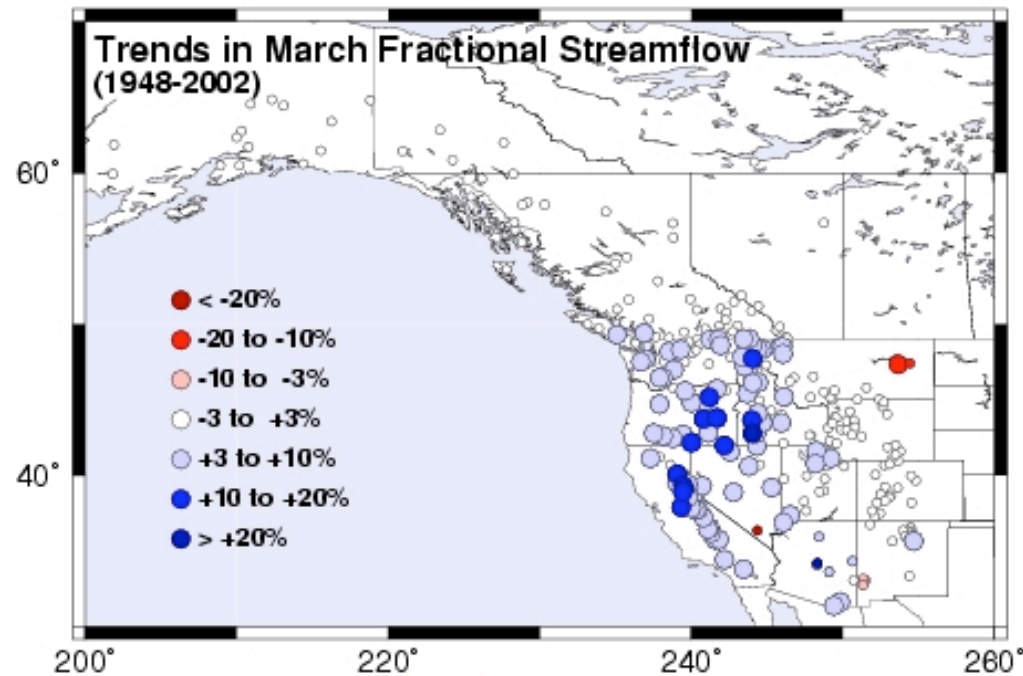


P.A. Stott GRL 2003

Streamflow of the future



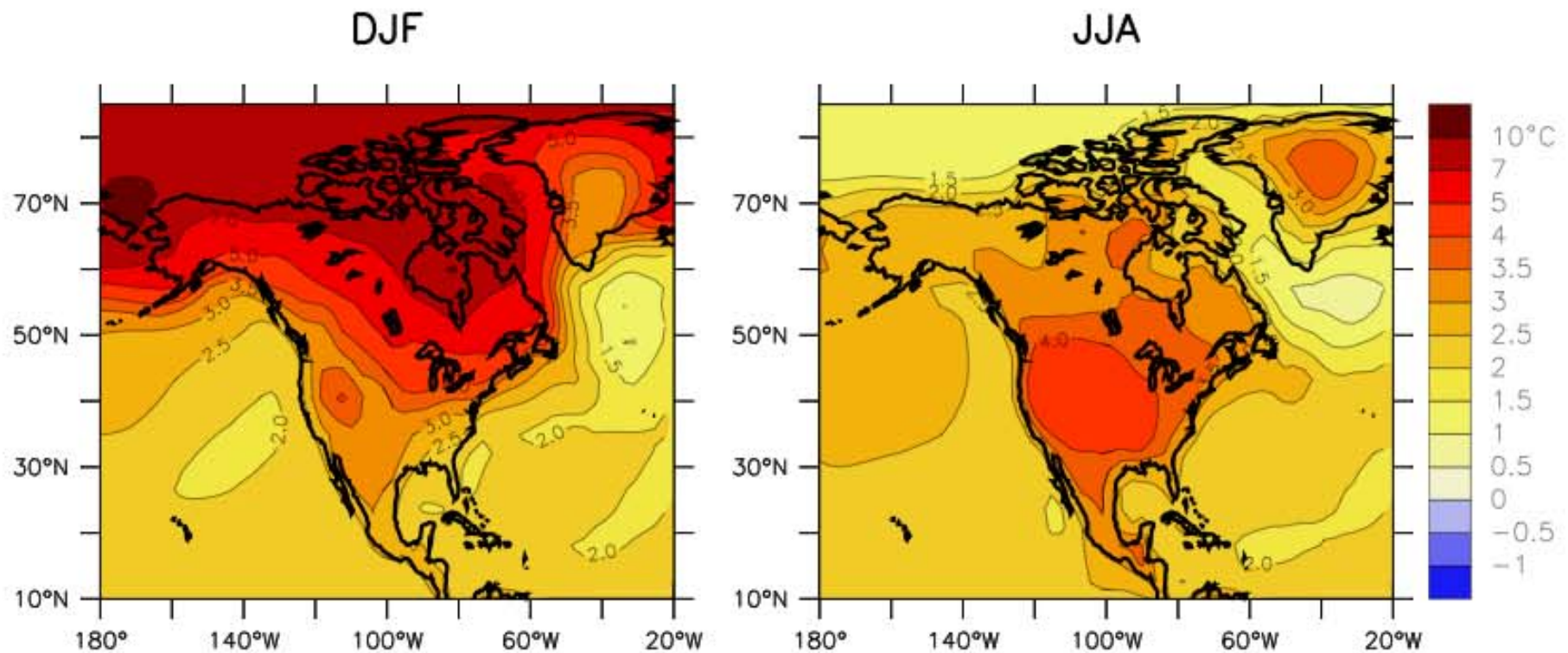
Three changes in a warming climate



As the West
warms,
winter flows rise
and summer flows
drop

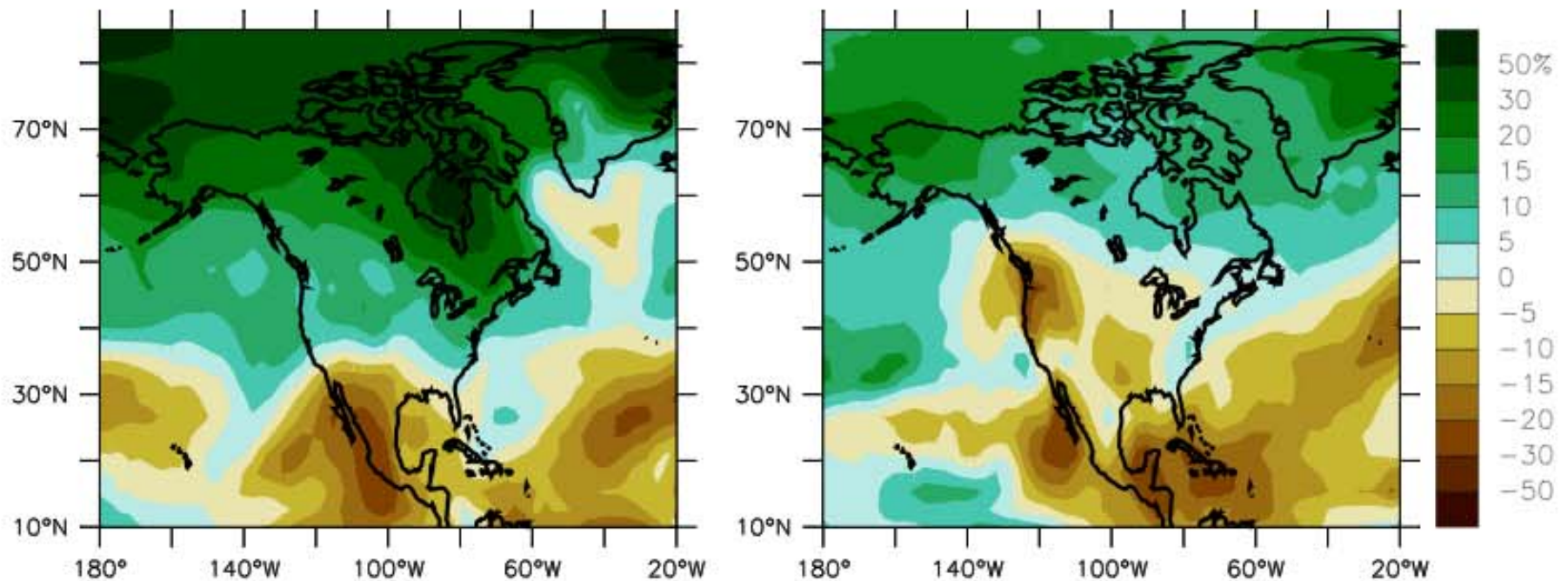
Stewart et al. J Climate 2005

Temperature change 2080-99 minus 1980-99



Averaged over 21 global models; IPCC Fig 11.12

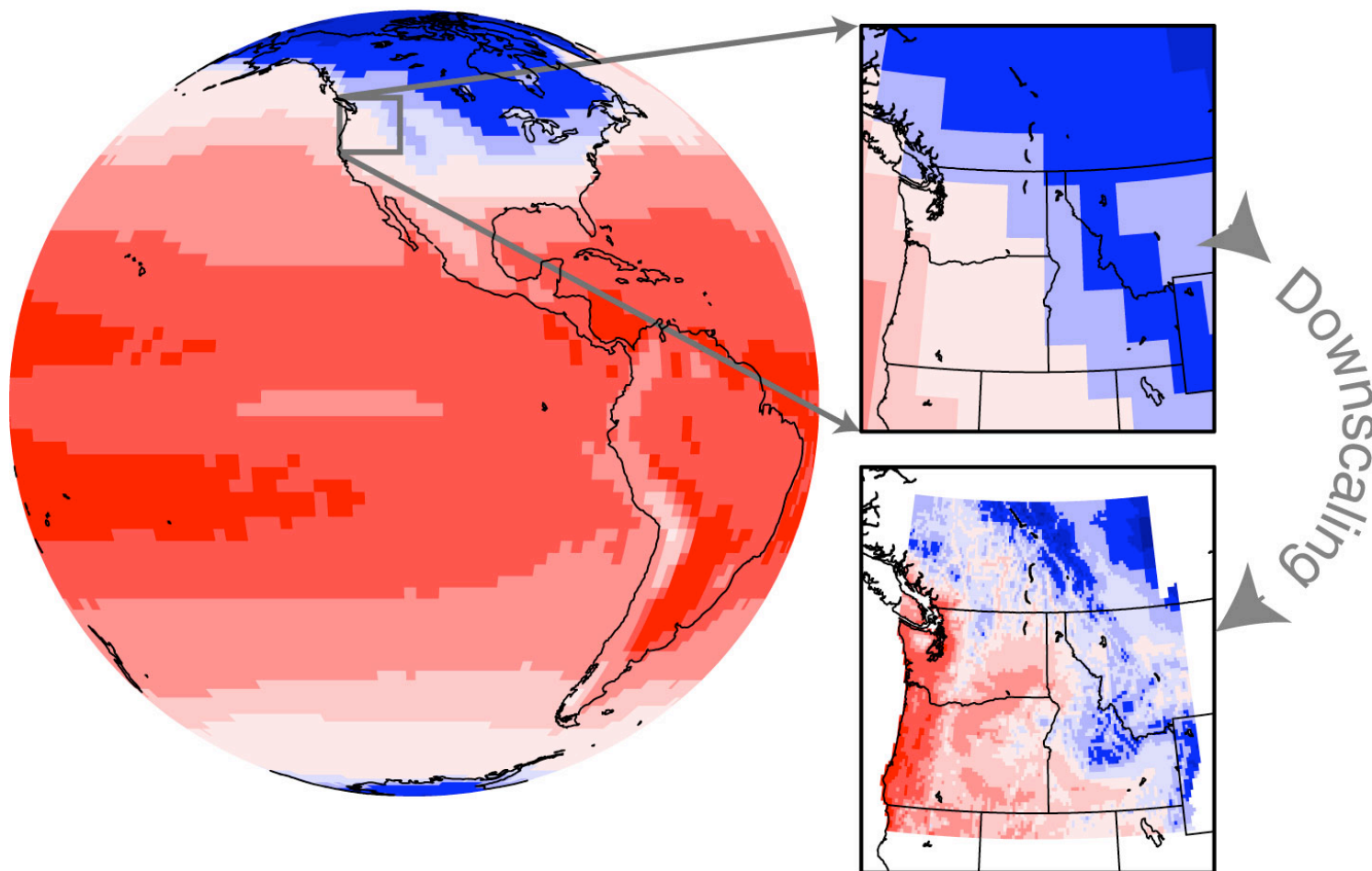
Precipitation change 2080-99 minus 1980-99



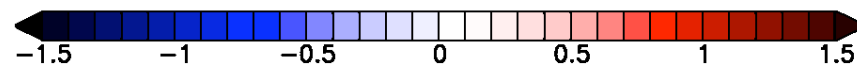
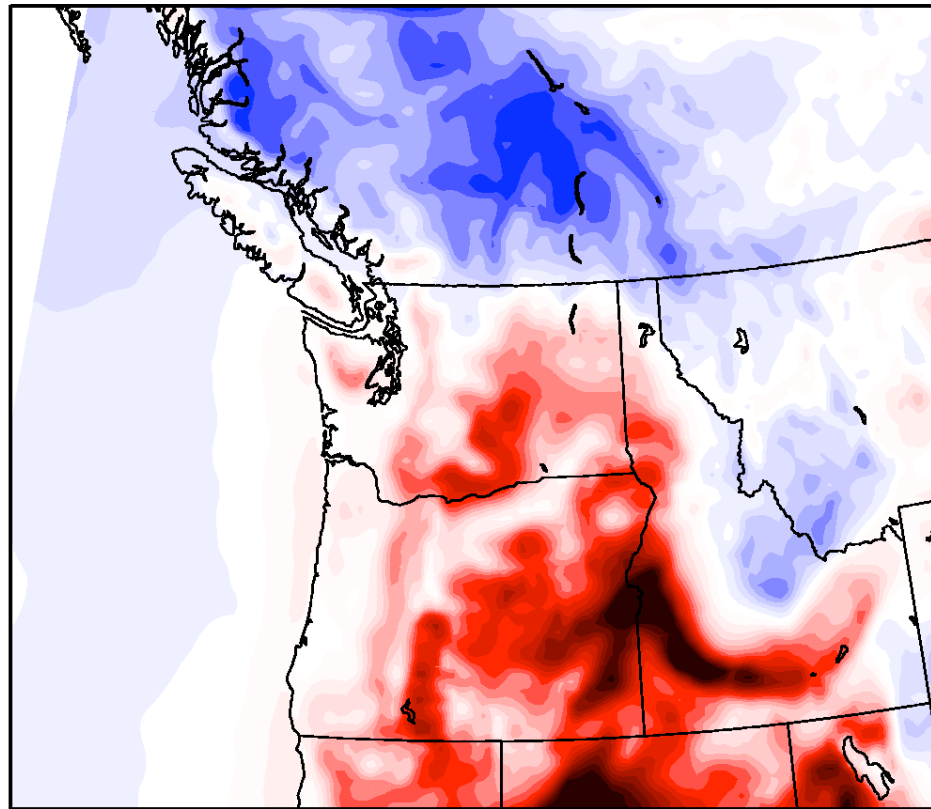
Averaged over 21 global models; IPCC Fig 11.12

Downscaling

Global Climate Model Air Temperature



Texture of warming: Regional model minus global model for 2050s



Difference in projected winter temperature ($^{\circ}\text{C}$)



"I'd chalk it up to just another crazy backyard hobby, except that he's the world's leading authority on global warming."



Sea Level Rise in the Coastal Waters of Washington State

Philip Mote, Alexander Petersen, and Lara Whitely Binder (CIG)
Spencer Reeder, Hugh Shipman (Wa Dept of Ecology)

www.cses.washington.edu/cig/

What controls local sea level

- Global sea level 21st century changes
 - thermal expansion
 - melting land ice
- Wind-driven sea level
- Local vertical land movements

Global sea level

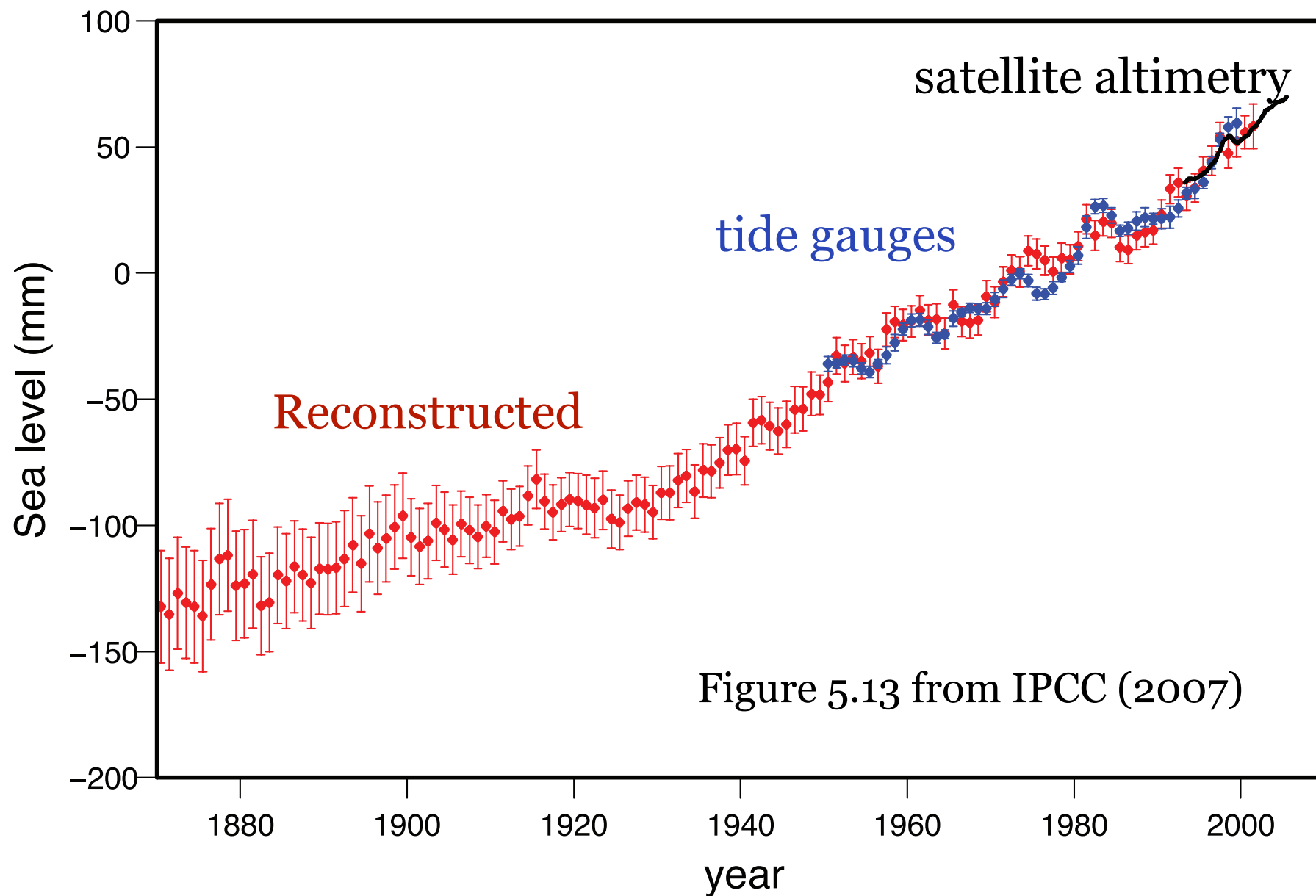


Figure 5.13 from IPCC (2007)

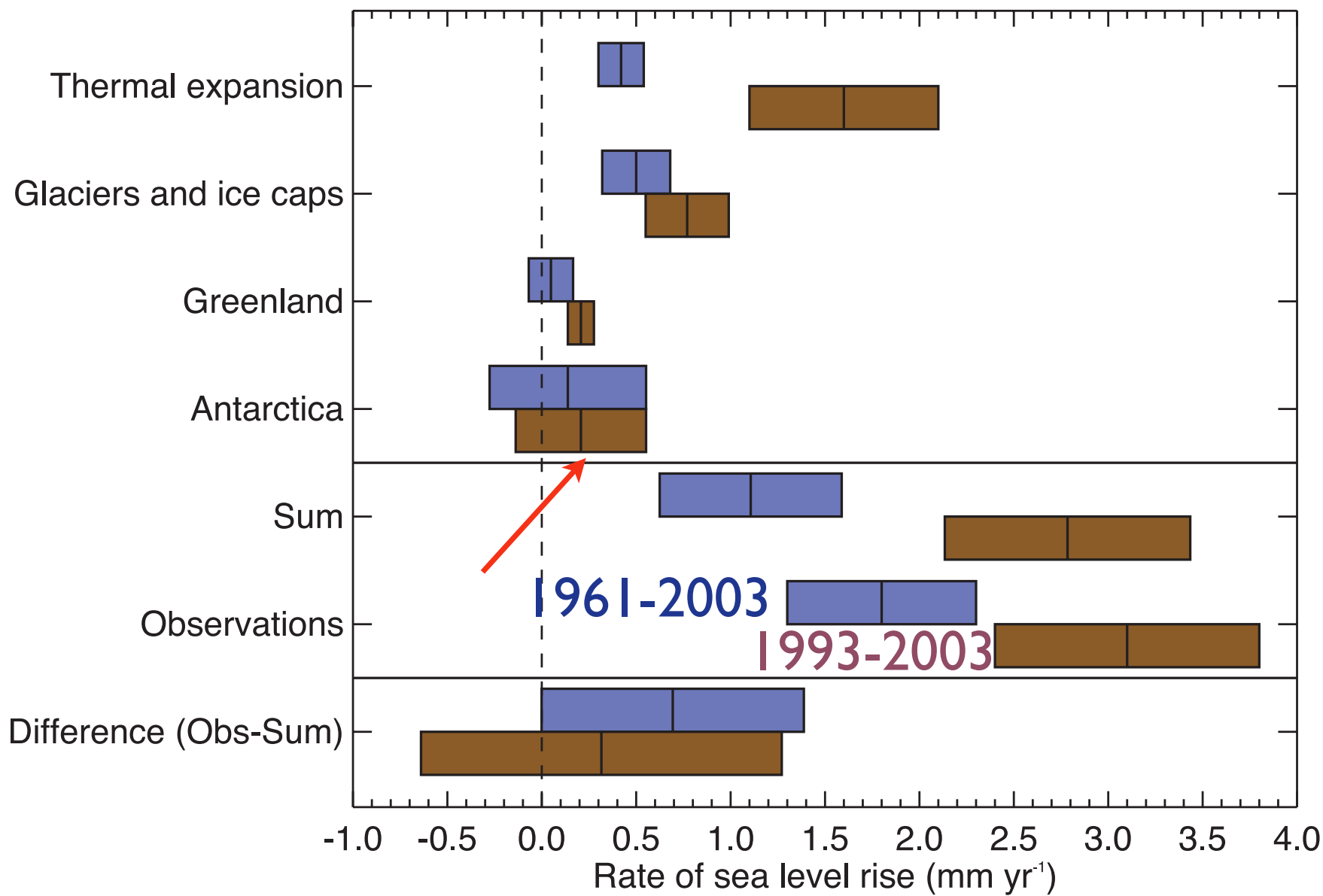
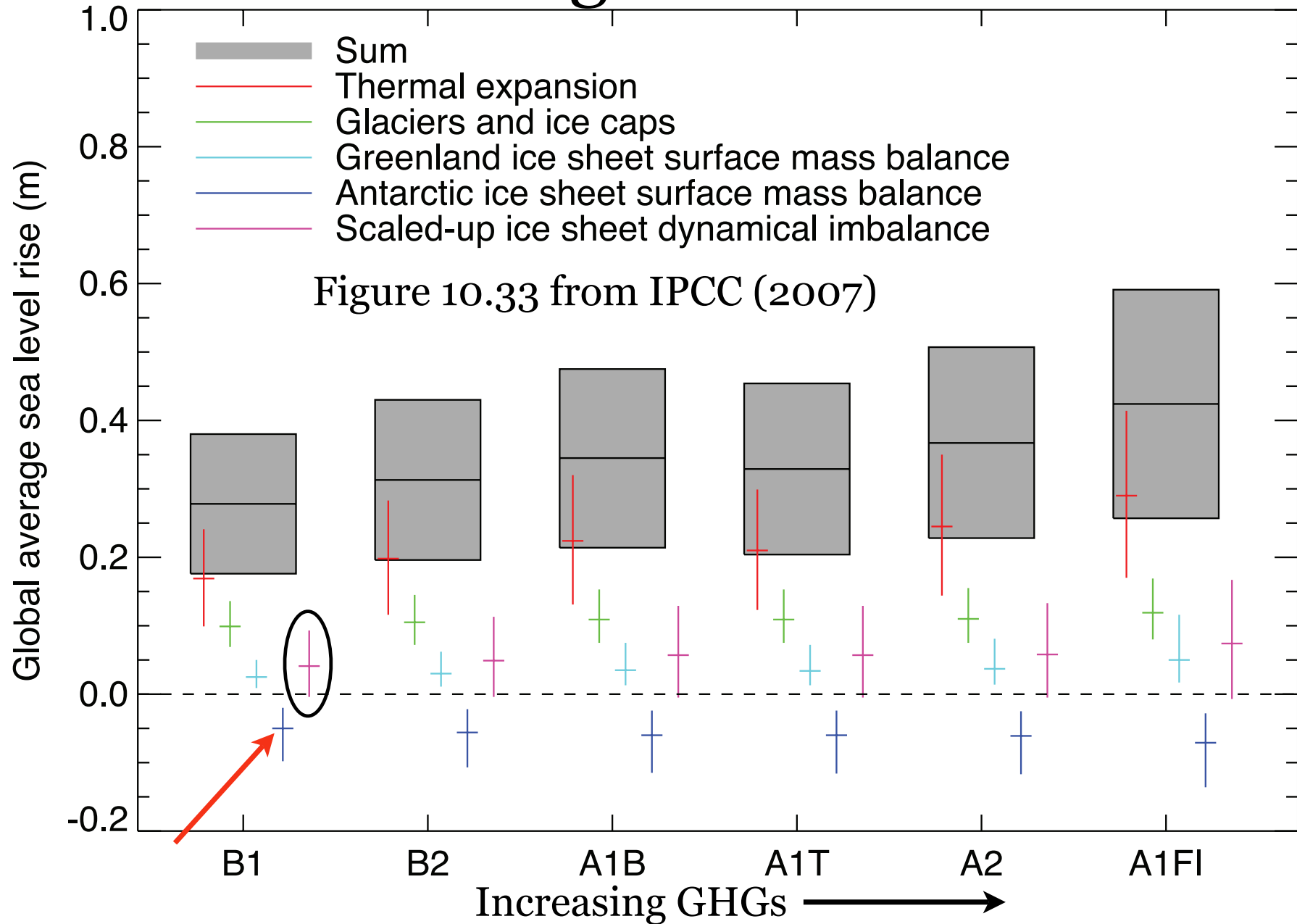
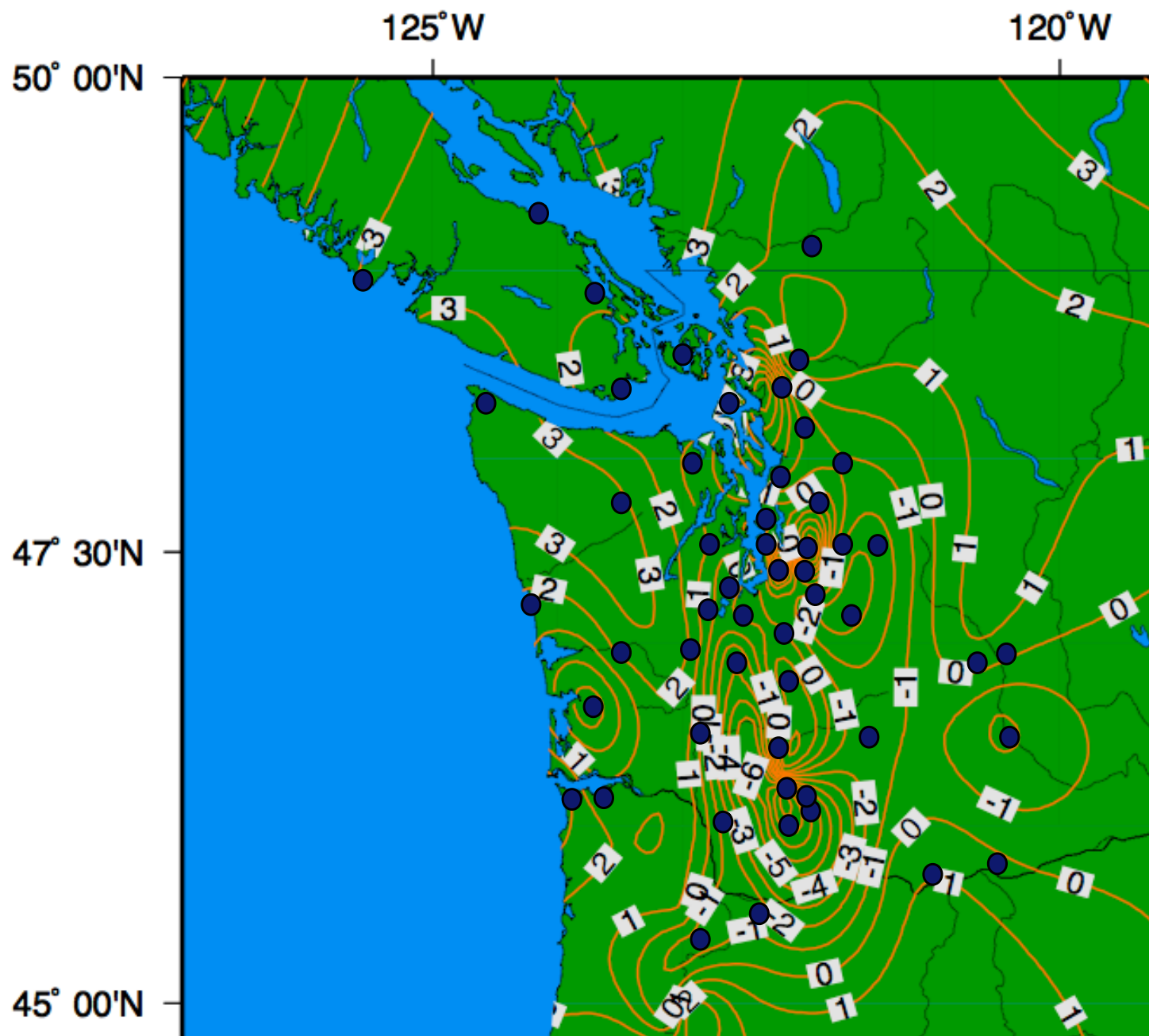


Figure 5.21 from IPCC (2007)

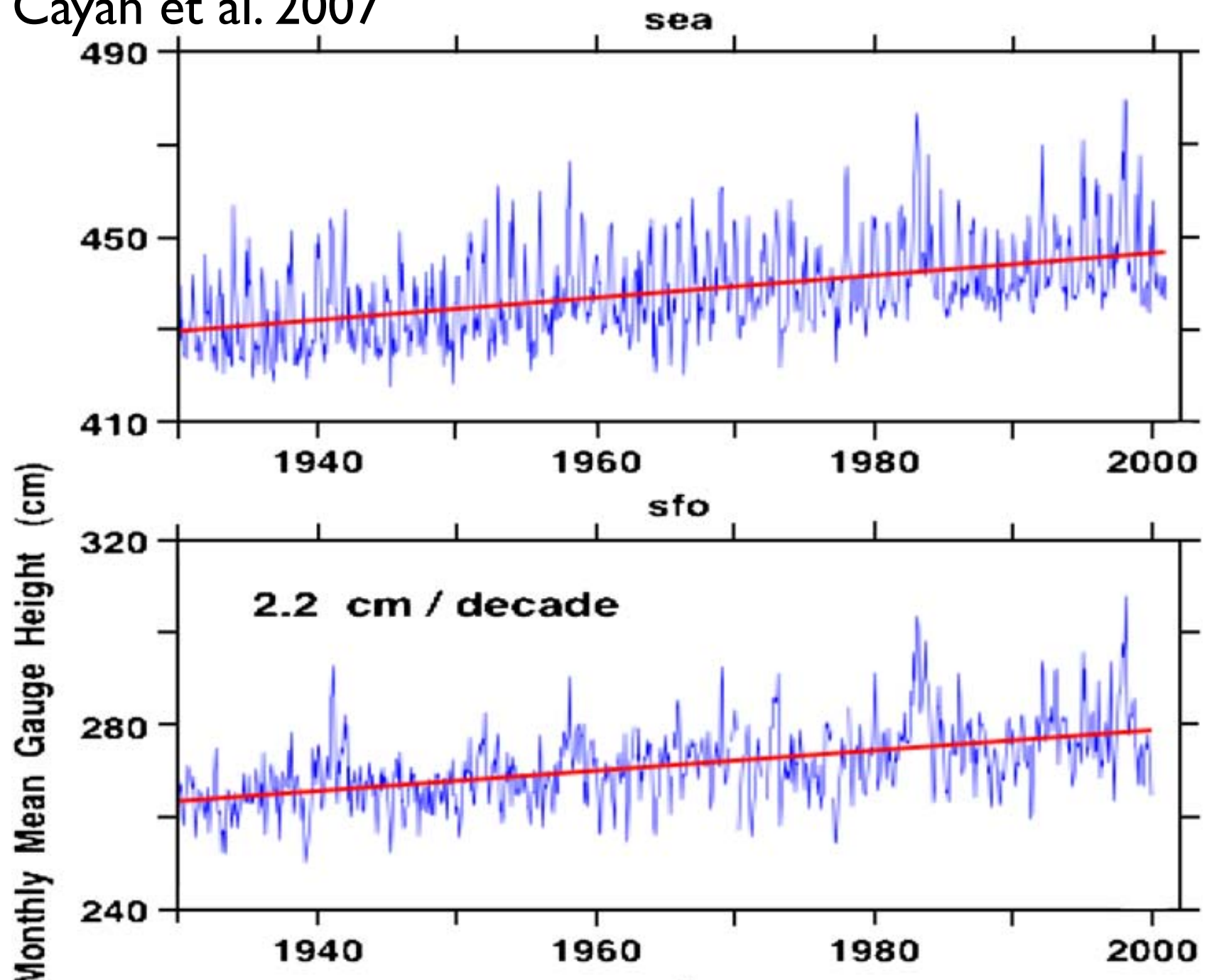
Future global sea level

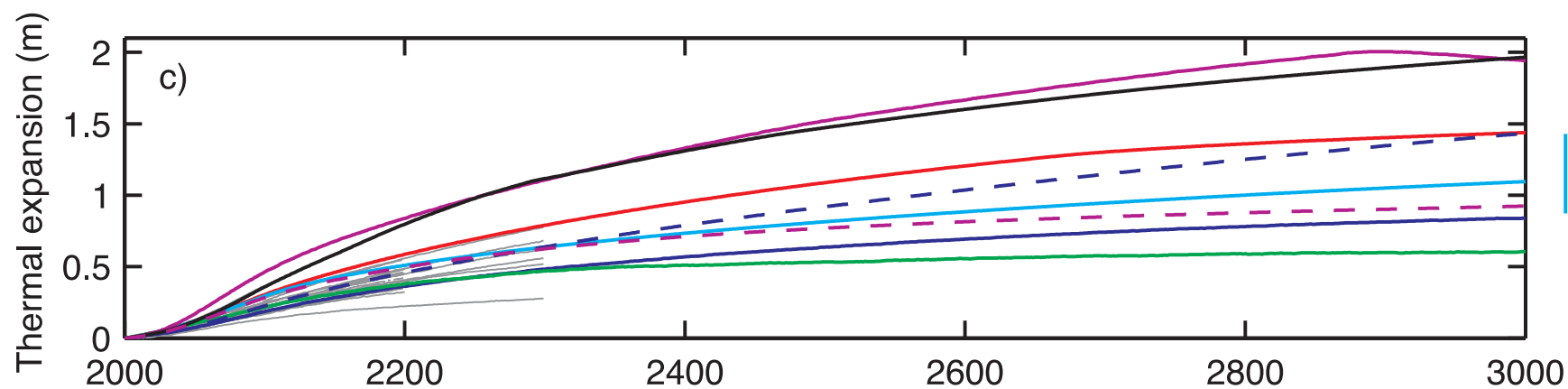
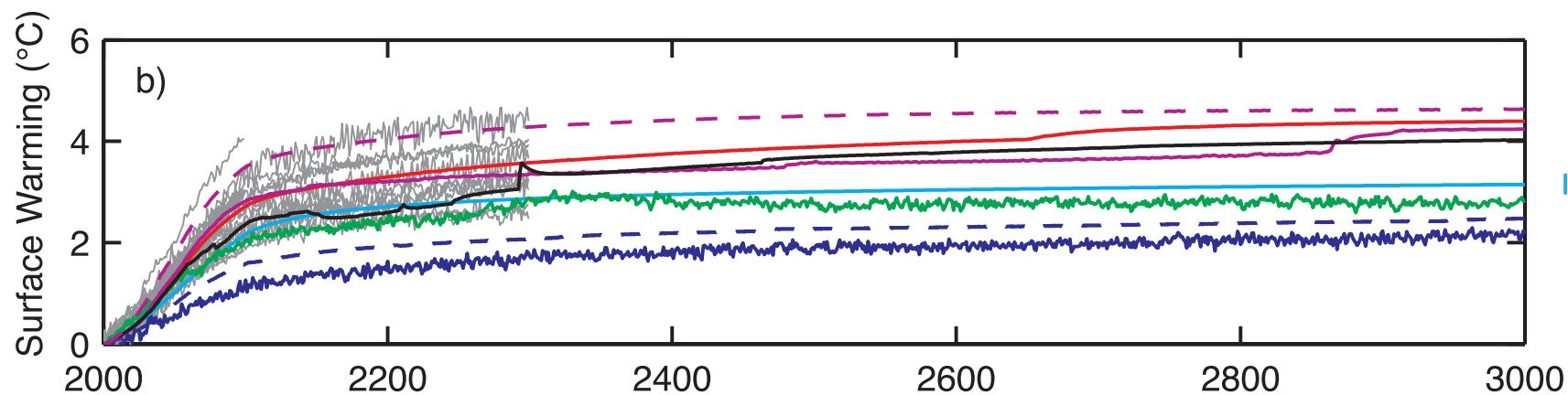
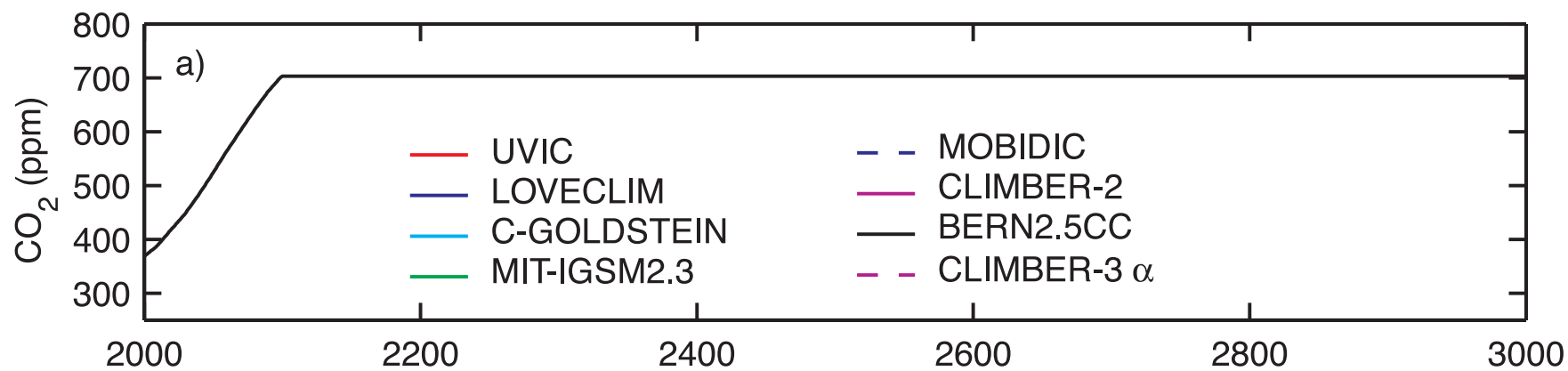




SLR Estimate	Components	2050			2100		
		<u>NW Olympic Peninsula</u>	<u>Central & Southern Coast</u>	<u>Puget Sound</u>	<u>NW Olympic Peninsula</u>	<u>Central & Southern Coast</u>	<u>Puget Sound</u>
Very Low	Global SLR	9 cm			18 cm		
	Atm. Dynamics	-1 cm			- 2 cm		
	VLM	-20 cm	- 5cm	0 cm	- 40 cm	-10 cm	0 cm
	Total	-12 cm (-5")	3 cm (1")	8 cm (3")	-24 cm (-9")	6 cm (2")	16 cm (6")
Medium	Global SLR	15 cm			34 cm		
	Atm. Dynamics	0 cm			0 cm		
	VLM	- 15 cm	- 2.5 cm	0 cm	-30 cm	- 5 cm	0 cm
	Total	0 cm (0")	12.5 cm (5")	15 cm (6")	4 cm (2")	29 cm (11")	34 cm (13")
Very High	Global SLR	38 cm			93 cm		
	Atm. Dynamics	7 cm			15 cm		
	VLM	-10 cm	0 cm	10 cm	- 20 cm	0 cm	20 cm
	Total	35 cm (14")	45 cm (18")	55 cm (22")	88 cm (35")	108 cm (43")	128 cm (50")

Cayan et al. 2007





CONCLUSIONS

- ✻ Regional-scale warming can now be attributed to rising greenhouse gases
- ✻ Many hydrologic changes consistent with warming - will require policy and operational changes
- ✻ Sea level rise - ice sheets the wild card